U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Outdoor Lighting Control Systems: Opportunities and Obstacles



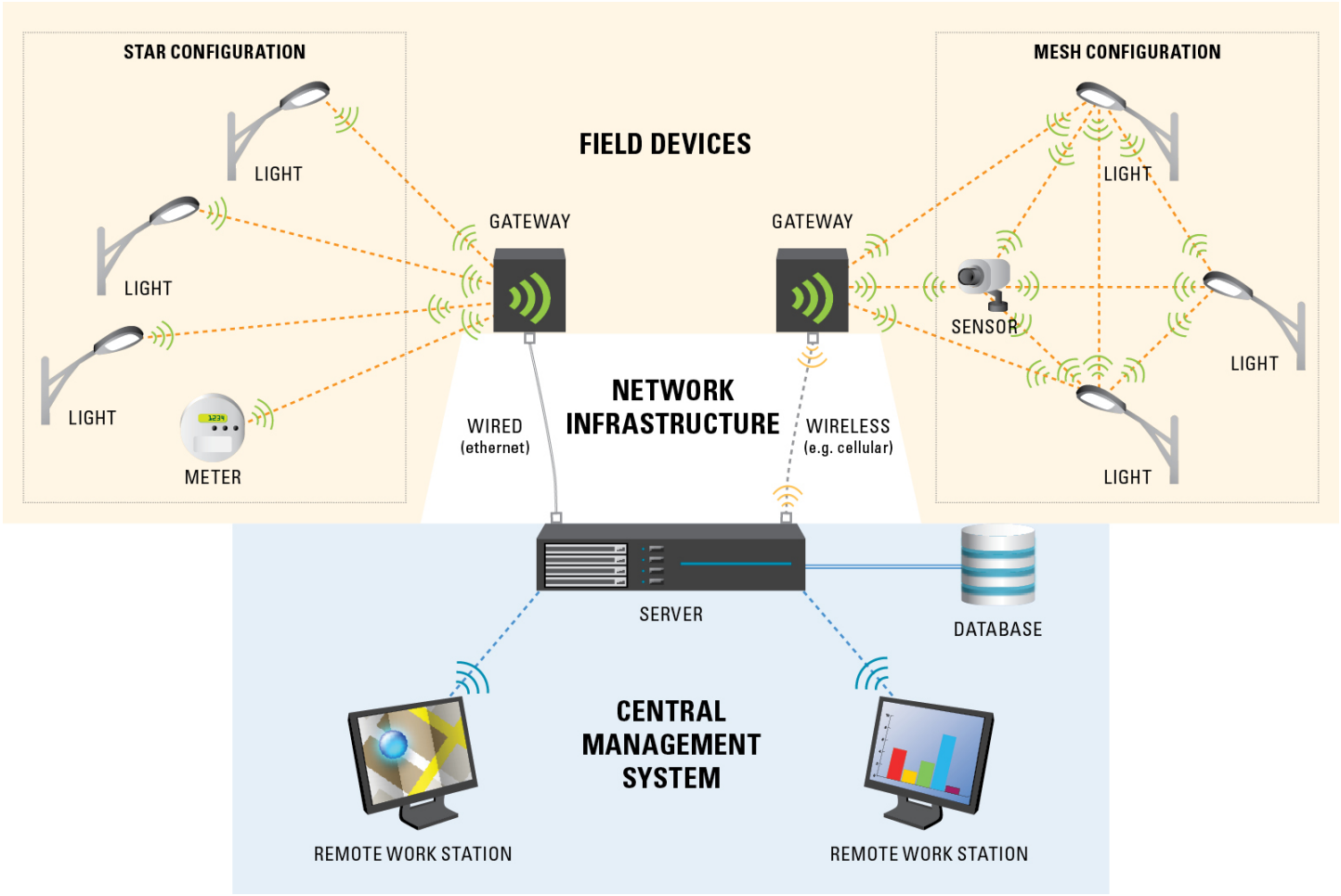

Lightfair

June 3-5, 2014

Michael Poplawski

Pacific Northwest National Laboratory

Networked Outdoor Lighting Controls



Opportunities and obstacles

Opportunities

- Energy and cost savings
- Improved quality of service
- Infrastructure asset enhancement

Obstacles

- Payback time
- User diversity
- New market growing pains
- Cloudy vision

Energy and cost savings

Remote monitoring

- Luminaire outages
- Luminaire dayburners
- Abnormal luminaire behavior
- Device energy consumption
  - For internal accounting?
  - For billing?
- Copper wire theft

Adaptive lighting

- Static
  - Predictable
  - Scheduled
- Dynamic
  - Unpredictable
  - Sensor-based
- Tuning
  - Lumen maintenance
  - Application
  - Preference

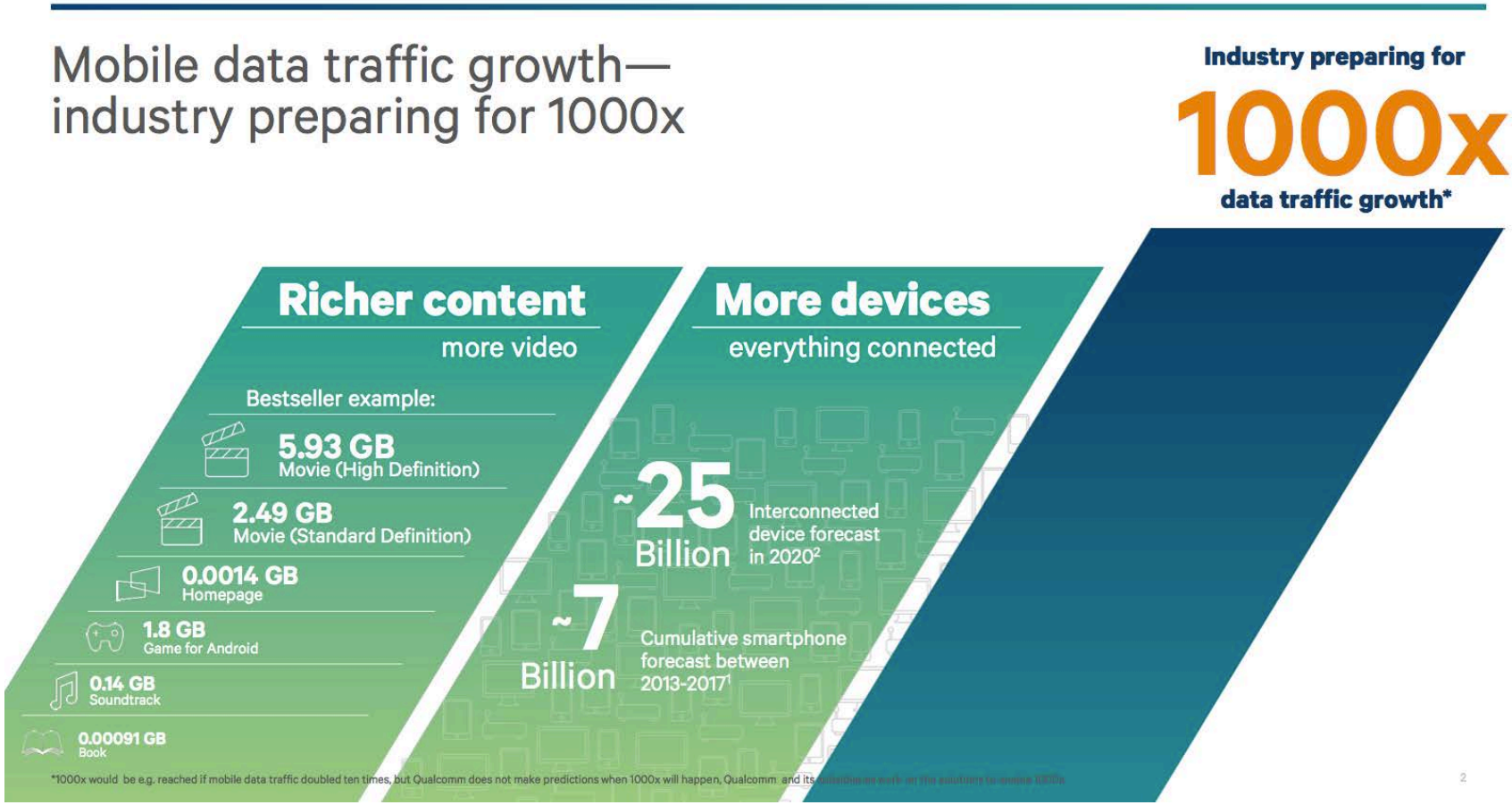
Improved quality of service

- Asset management
- Failure response time
- Customer-driven adaptive lighting
- Safety, security, special events (Municipalities)
  - Fire, Police, Emergency Response, Medical Services
  - Enhanced/degraded vision, wayfinding, messaging
  - Custom light levels, spectrum for concerts, festivals, observatory research, filming
- Interaction with Smart Grid (Utilities)
  - Demand response
  - Power quality monitoring

Infrastructure asset enhancement

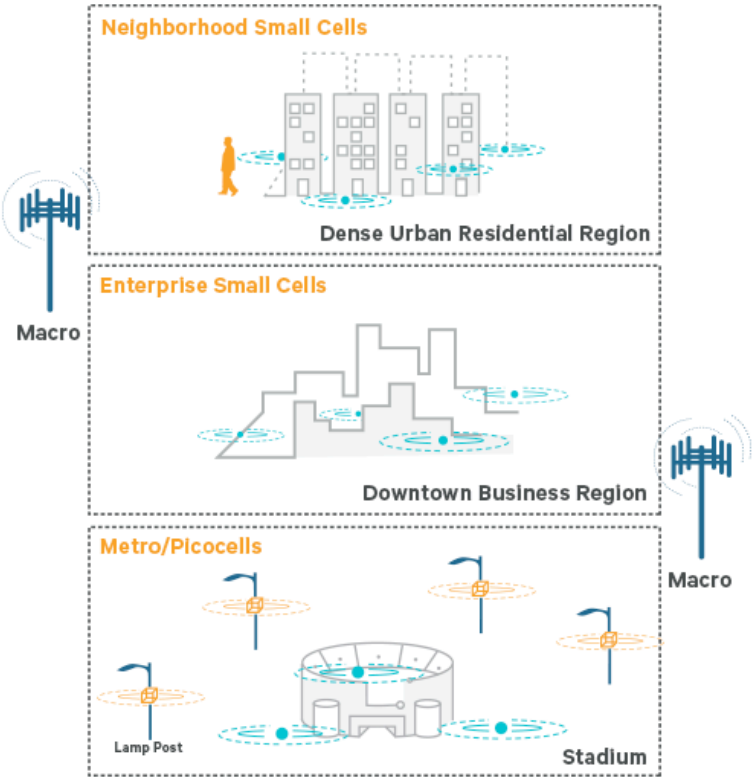
- Non-lighting services
  - Asset management of other (non-lighting) infrastructure
  - Network connection of other (non-lighting) devices
  - Field-to-field communication with other (non-lighting) devices
- Revenue opportunities
  - Interdepartmental network access
  - Federal network access (e.g. Homeland Security)
  - Commercial network access (e.g. cellular microcells)
  - Fee based services (e.g. parking meters, EV chargers)

Mobile data traffic



http://www.qualcomm.com/solutions/wireless-networks/technologies/1000x-data

Cellular microcells

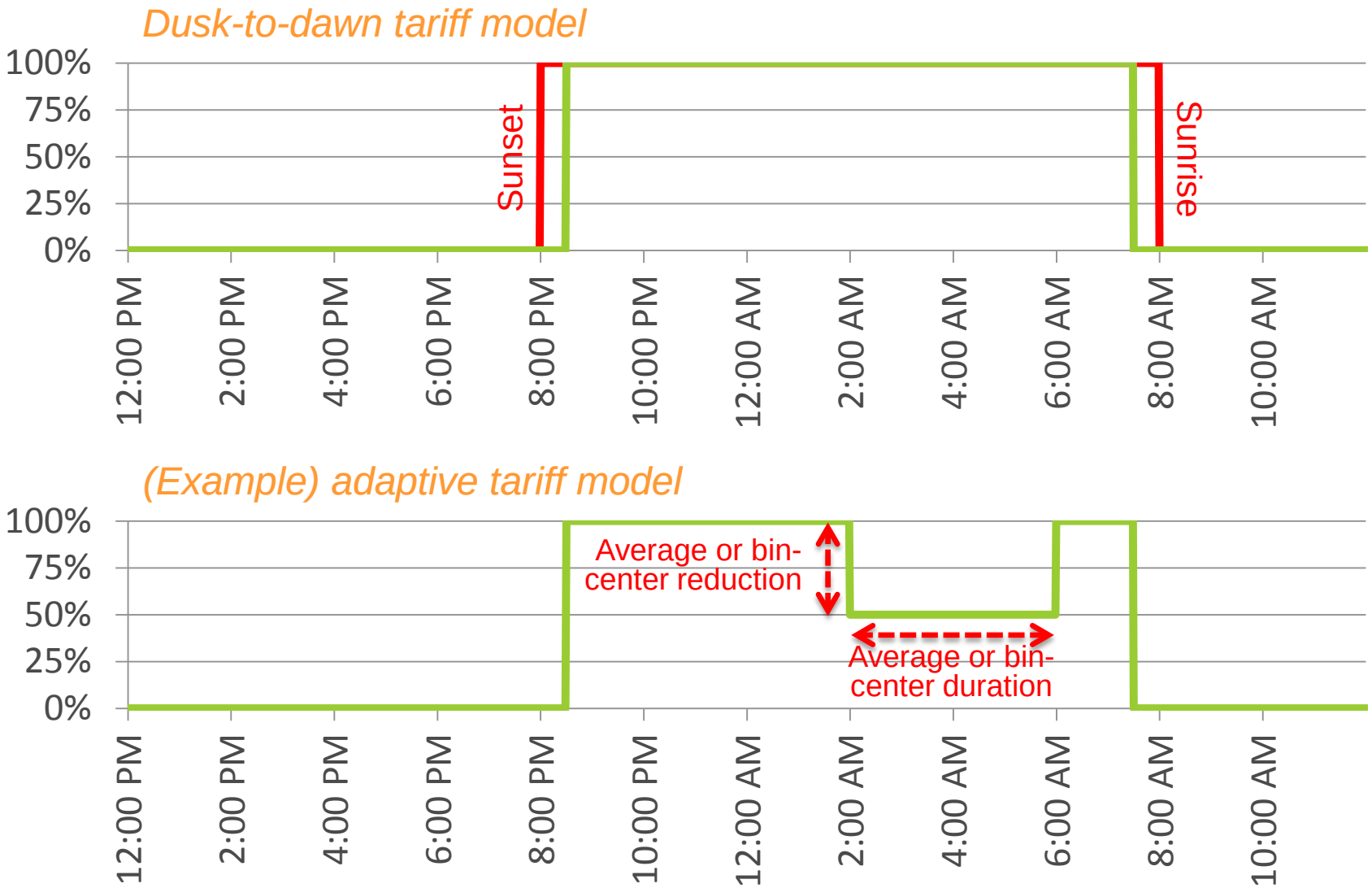


http://www.qualcomm.com/media/documents/traffic-mgmt-and-offload-strategeies-operators
http://www.qualcomm.com/innovation/research/feature_project/femtocells.html
http://bits.blogs.nytimes.com/2014/02/24/philips-and-ericsson-to-use-streetlights-to-expand-cellphone-coverage/

Payback time

- Cost on par with LED luminaire
- Limited clear value propositions
  - Maintenance cost savings from remote monitoring
  - Energy savings from remote monitoring
  - Energy savings from adaptive lighting?
- Inability to monetize energy savings
  - Requires new utility tariff(s)
  - Existing utility infrastructure does not support accepting metering data
  - Existing metering standards (ANSI C12.1, 12.20) not (directly) applicable
  - New ANSI C136.50 in development

Adaptive lighting tariff examples



User diversity

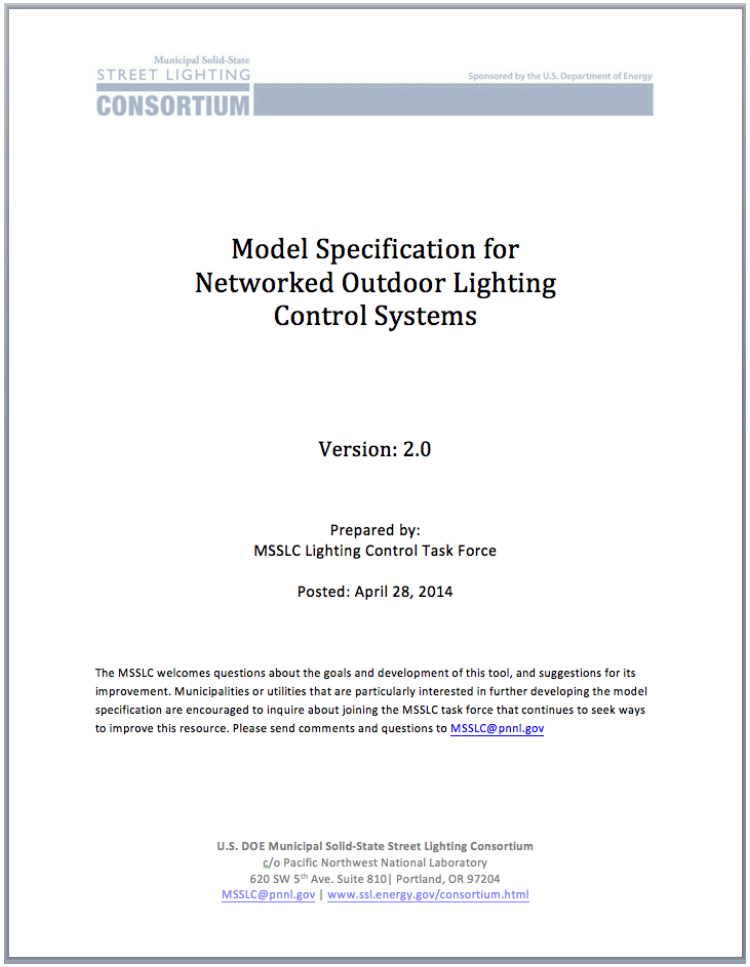
- Utilities and municipalities and have different vested interests
- Different utilities see value propositions differently
- Different municipalities see value propositions differently
- Size matters

Early adopter experiences

- Los Angeles, CA:http://www1.eere.energy.gov/buildings/ssl/consortium-la_video.html
- San Jose, CA: http://www.sanjoseca.gov/index.aspx?NID=1898
- Glendale, AZ: https://www.glendaleaz.com/transportation/streetlights/streetlightmonitoringsystem.cfm

New market growing pains

- Immature products
  - Mature core technology
  - Start-up/provisioning and commissioning
  - Getting better quickly
- User learning curve
- Match desirable feature set(s) to user type(s)
  - One size does not fit all
  - MSSLC Model Specification



Municipal Solid-State STREET LIGHTING CONSORTIUM

Sponsored by the U.S. Department of Energy

Model Specification for Networked Outdoor Lighting Control Systems

Version: 2.0

Prepared by:
MSSLC Lighting Control Task Force

Posted: April 28, 2014

The MSSLC welcomes questions about the goals and development of this tool, and suggestions for its improvement. Municipalities or utilities that are particularly interested in further developing the model specification are encouraged to inquire about joining the MSSLC task force that continues to seek ways to improve this resource. Please send comments and questions to MSSLC@pnnl.gov

U.S. DOE Municipal Solid-State Street Lighting Consortium
c/o Pacific Northwest National Laboratory
620 SW 5th Ave. Suite 810| Portland, OR 97204
MSSLC@pnnl.gov | www.ssl.energy.gov/consortium.html

http://www1.eere.energy.gov/buildings/ssl/control-specification.html

Cloudy vision

- Insufficient adaptive lighting guidance
  - Adapt to changing: pedestrian conflict (IES RP-8), weather?
  - Determine changes via: real-time measurements? models? related data (e.g. mass transit schedules), zone classifications?
  - Liability concerns
- Enabling technology
  - Sensor performance and cost
  - Integration with other (existing, and future) systems
- Conflicting or overlapping missions, initiatives
  - Infrastructure maintenance costs
  - Existing communication networks
  - Visual clutter
- Changing landscape

Changing landscape

- Billing energy consumption for outdoor equipment
  - Fixed tariff or metered tariff?
  - Meter requirements (accuracy, dynamic range)?
- Field devices
  - Meter ownership?
  - Data security?
- Communication networks
  - Private or public?
  - New vs. existing (e.g. cellular)
- Pay for equipment or service
  - Capital vs. recurrent expense
  - Central management, network infrastructure,
  - Field devices? Light?
- Future needs, opportunities
  - Network access
  - Integration with other systems
  - New features
  - Revenue stream

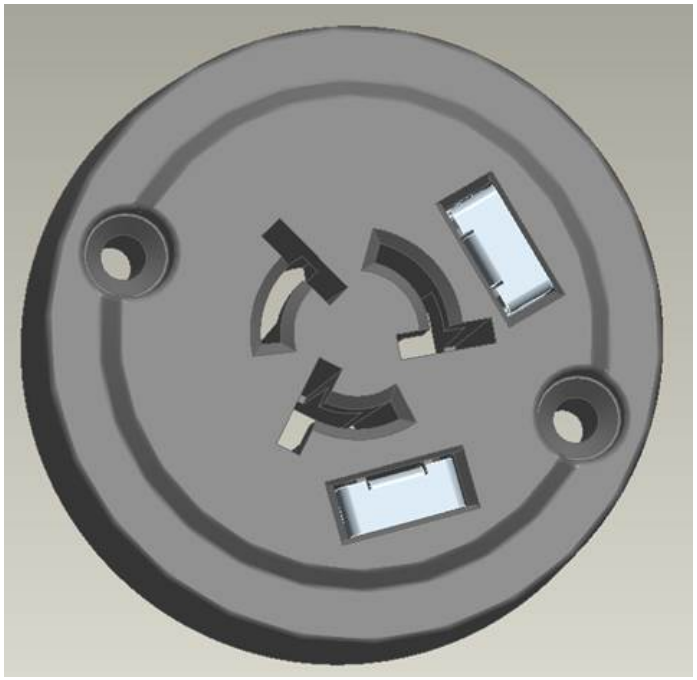
Managing risk: “Control-ready”

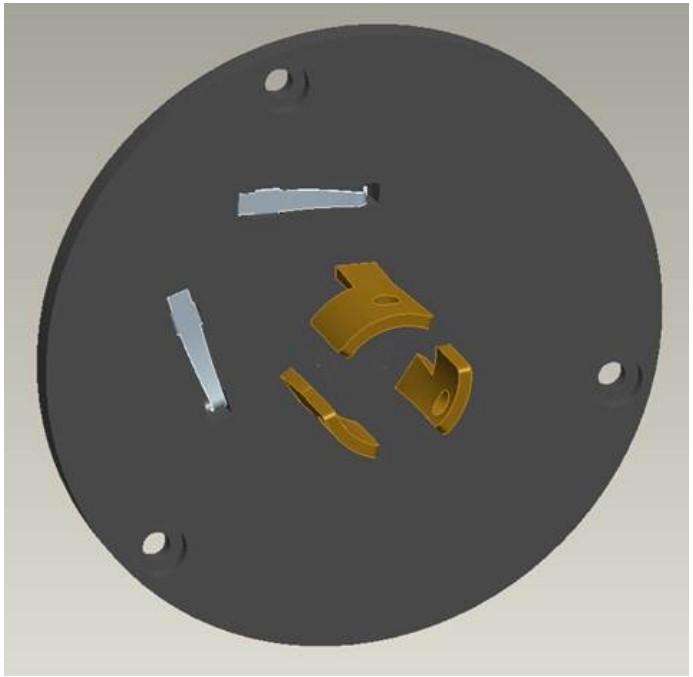
- What?
  - Dimmable LED driver
  - Low additional up-front material cost
  - Low future upgrade labor cost
- Why?
  - Growing adoption of LED luminaires
  - Minimize cost to add control later

- How?
  - Exterior plug/receptacle
  - Power-door replacement
  - LED driver replacement
  - Interior plug/receptacle
  - Firmware upgrade

Control-ready outdoor luminaires

ANSI C136.41-2013: “Dimming Control Between an External Locking Type Photocontrol and Ballast or Driver”





https://www.nema.org/Standards/Pages/For-Roadway-and-Area-Lighting-Equipment-Dimming-Control-Between-an-External-Locking-Type-Photocontrol-and-Ballast-or-Driver.aspx

Managing risk: Interoperability

- Why?
  - Reduce user risk
  - Facilitate application specific solutions
  - Access to best-in-class products and services
- Where?
  - Physical layer?
  - Application layer?
- When?
  - Market adoption bottleneck
  - Mature feature definition, technology
- How?
  - TALQ Consortium
  - LonMark

Compatibility, Interoperability, Interchangeability

- Two devices (or a device and a system) are compatible if they can operate in a system (or in the same physical environment) without corrupting, interfering with, or hindering the operation of the other entity.
- Two devices (or a device and a system) are interoperable if they can both operate as intended, while sharing a common defined set of information.
- Two devices are interchangeable if they can be physically exchanged for each other, and provide (near) identical operation in a system without additional configuration.

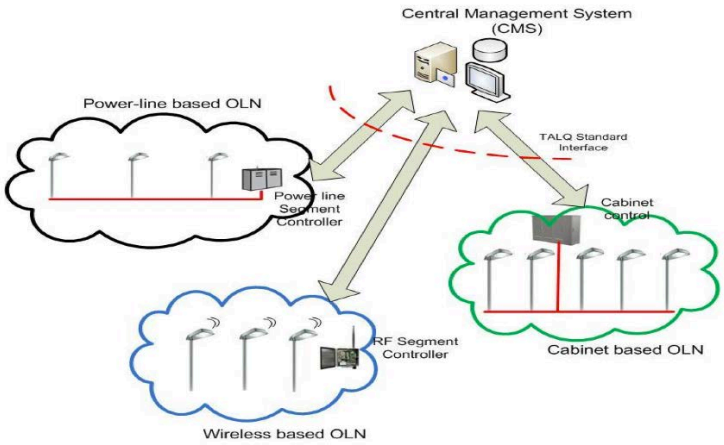
Interoperable platforms

TALQ Consortium

For the standardization of a management software interface for Outdoor Lighting Networks

Welcome to the TALQ Consortium website!

The TALQ Consortium is a new consortium of lighting industry players. We aim to set a globally accepted standard for management software interfaces to control and monitor for heterogeneous outdoor lighting networks and thus create interoperability between outdoor lighting networks.



http://www.talq-consortium.org/

LonMark® International

Lower energy and maintenance costs on your streetlight network while using it as the backbone of your smart city.

Can you imagine a camera that could only take pictures visible on a screen manufactured by the same supplier? Can you imagine a computer from which you can send emails only to computers from the same supplier? Unlike proprietary systems, open systems such as the one proposed by LonMark provide many models of light point controllers from many suppliers, all compatible and interoperable with each other in the same street and on the same network.

See an impressive demonstration of a multi-vendor networked streetlight system in hall 5.0, stand C12 in the Urban Lighting area at Light & Building 2014. Several competing manufacturers will demonstrate their networked luminaires and system software, including: **Osram, Rongwen, Thorn, Amko, Vossloh-Schwabe, Citylone, APANET, Echelon, Adic, Flashnet and Streetlight.Vision**.

http://www.lonmark.org/connection/solutions/lighting/streetlighting

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Questions?

Lightfair

June 3-5, 2014

Michael Poplawski

Pacific Northwest National Laboratory